

1990 AGRICULTURAL WEED CONTROL GUIDE

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INTRODUCTION

THE WEED CONTROL SUGGESTIONS presented in this guide are based on Federal label clearance and on information obtained from the North Dakota Agricultural Experiment Station and the Research Report of the North Central Weed Control Conference.

CAUTION: The weed control suggestions in this circular are based on the assumption that all herbicides mentioned in this guide will continue to have a registered label with the Environmental Protection Agency. USE PESTICIDES ONLY AS LABELED.

RESTRICTED USE HERBICIDES. Certification is required for purchase and use of restricted use herbicides, picloram (Tordon), diclofop (Hoelon), paraquat (Gramoxone Extra, Cyclone), sulfuric acid, amitrole (Amitrol-T, Cytrol), cyanazine (Bladex) and alachlor (Lasso), bromoxynil (Buctril, Bronate), and pronamide (Kerb).

RATES ARE BASED on broadcast application and are expressed as active ingredient or acid equivalent, and as the amount of commercial product. Commercial formulations of the same herbicide may vary in amount of active ingredient. For example, a pint of 4-pound acid equivalent per gallon 2,4-D contains 0.5 pound, while a pint of 6-pound acid equivalent per gallon contains 0.75 pound. Three pounds of atrazine (AAtrex 80W) powder contains 2.4 pounds active ingredient ($3 \times 0.80 = 2.4$), or 3 pounds active ingredient is 3.75 pounds of product ($3 / 0.80 = 3.75$).

WEED COMPETITION reduces crop yields severely, unless weeds are removed when small. Good cultural practices are one of the many methods of controlling weeds. However, selective herbicides at the recommended rate will control many annual weeds satisfactorily without damaging the crop in which the weeds are growing.

GENERAL INFORMATION

POSTEMERGENCE HERBICIDES:

Effectiveness of postemergence herbicides is influenced by crop tolerance, weed species and climatic conditions and should be considered in determining the rate of herbicide to apply. A range of rates is given for most of the herbicides in this circular. Use the lowest recommended rate of postemergence herbicides under favorable growing conditions when weeds are small and actively growing. Under adverse conditions of drought or prolonged cool weather, or for well established weeds, use the highest suggested rate, unless otherwise directed.

Ideal temperatures for applying most postemergence herbicides are between 65 to 85 F. Below 60 F weeds are killed very slowly or not at all; above 85 F there is danger of herbicide injury to the crop. Avoid applying volatile herbicides such as 2,4-D ester, MCPA ester and dicamba (Banvel) during hot weather, especially near sensitive broadleaf crops, shelterbelts, or farmsteads.

Rainfall shortly after application often reduces weed control from postemergence applications because the herbicide is washed off the leaves before absorption is complete. Herbicides vary in rate of absorption and in ease of being washed from leaves; therefore, herbicides vary in response to rainfall. The amount and intensity of rainfall influence the washing of herbicide from leaves. The approximate time between application and rainfall needed for maximum weed control from several herbicides follows:

Herbicide	Time Interval	Herbicide	Time Interval
acifluorfen (Blazer)	6 hours	DPX-L5300 (Express)	4 hours
atrazine + oil (Aatrex)	4 hours	DPX-M6316 + DPX L5300 (Harmony Extra)	4 hours
barban (Carbyne)	5 minutes	fenoxaprop (Whip)	1 hour
bentazon + oil (Basagran)	8 hours	fluazifop-P (Fusilade 2000)	1 hour
bromoxynil (Buctril)	1 hour	glyphosate (Roundup, Ranger)	6 hours
chlorsulfuron (Glean)	4 hours	lactofen (Cobra)	0.5 hour
cyanazine (Bladex)	2 hours	2,4-D or MCPA amine	4 hours
desmedipham (Betanex)	6 hours	2,4-D or MCPA ester	1 hour
desmedipham + phenmedipham (Betamix)	6 hours	metsulfuron (Ally)	4 hours
dicamba (Banvel)	6-8 hours	propanil + MCPA (Stampede CM)	4 hours
diclofop (Hoelon)	1 hour	sethoxydim (Poast)	1 hour
difenoquat (Avenge)	6 hours	quizalofop (Assure)	1 hour

SPRAY ADDITIVES:

Spray additives consist of oils, surfactants, and fertilizers. The most effective additive often will vary with different herbicides and the need for an additive will vary with environment, weeds present, and herbicide. Additives should be used only when indicated on the herbicide label as they may increase injury to crops or reduce weed control. Oils generally are used at 1% v/v (1 gallon per 100 gallons of spray solution) or at 1 pt to 1 gal/A depending upon herbicide and oil. Oil additives function to increase herbicide absorption and spray retention. Surfactants are used at 0.12 to 0.5% v/v (1 to 4 pt per 100 gallons of spray solution). Surfactant rate depends on the amount of active ingredient in the surfactant and other factors. The main function of a surfactant is to increase the wetting of plants by the spray. When a range of surfactant rates is given, the high rate is for use with low rates of the herbicide, drought stress, tolerant waxy weeds, or when the surfactant contains a low (less than 50%) percentage active ingredient. X-77 and WK are examples of surfactants with more than 80% active ingredient. Fertilizers containing ammonium nitrogen occasionally have increased the effectiveness of barban, acifluorfen, glyphosate, bentazon, and sethoxydim. Fertilizer with herbicides also may reduce weed control or cause crop injury. Fertilizers should be used with herbicides only as indicated on the label or where experience has proven acceptability.

SPRAY AND VAPOR DRIFT:

Movement of herbicides off target is a problem in North Dakota each year as herbicides move from target fields into nontarget fields containing crops susceptible to the herbicide. Spray drift and crop injury are affected by several factors.

a) Spray particle size: Large droplets will drift less than small particles. Low spray pressures (20 to 30 psi) and nozzles which deliver high gallons per acre will increase spray droplet size.

b) Wind velocity and direction: To minimize spray drift injury, wind direction should be away from susceptible crops during herbicide application. The wind velocity should be less than 10 miles per hour; however, drift can occur even with lower wind velocities.

c) Distance between nozzle and target (boom height): Droplets should be released as close to the target as possible since less distance means less time to fall and therefore less drift.

d) Herbicide formulation: All herbicides can drift as spray droplets but some herbicides are sufficiently volatile to cause plant injury from vapor or fume drift. Herbicide volatility and consequent risk of damage to susceptible plants increases with increasing temperature. The so-called high volatile esters of 2,4-D or MCPA may produce damaging vapors at temperatures as low as 40 F while low volatile esters may produce damaging vapors between 70 and 90 F. Amine formulations are essentially non-volatile even at high temperatures. Temperature on the soil surface often is several degrees warmer than air temperature. Thus an applied low volatile ester could be exposed to temperatures high enough to cause damaging vapor formation even when the air temperature is below 70 F. Dicamba (Banvel) also is volatile and can drift as droplets or vapor. Herbicide vapor drifts further and over a longer time than spray droplets. A wind blowing away from susceptible plants during application will prevent damage from droplet drift but a later wind shift towards the susceptible plants could move damaging vapors to the plants. Thus, to minimize the risk of drift injury, herbicides such as 2,4-D esters, MCPA esters, and dicamba with high potential to form damaging vapors should not be used near susceptible plants.

e) Drift control: Certain spray nozzles or spray systems such as the Delavan Raindrop nozzle, the Spraying Systems LP nozzle or controlled droplet applicators produce droplets less subject to drift than droplets from conventional hydraulic nozzles. Nalco-Trol and other additives to spray mixtures cause larger droplets which may reduce drift. Drift control techniques that produce large spray droplets should not be used with postemergence herbicides that require small droplets for optimum performance such as barban (Carbyne 2EC), desmedipham (Betanex), bentazon (Basagran), sethoxydim, (Poast), fluazifop-P (Fusilade 2000), fenoxaprop (Whip), and quizalofop (Assure).

f) Injury from herbicide drift: Damaging drift to non-target plants is primarily a problem with 2,4-D, MCPA, dicamba (Banvel), paraquat (Gramoxone Extra, Cyclone), glyphosate (Roundup), DPX-M6316 (Pinnacle), DPX-M6316 and DXP-L5300 (Harmony Extra), DPX-L5300 (Express) and picloram (Tordon) in North Dakota. All herbicides may drift and cause significant damage to susceptible nontarget plants, so caution must be observed with all herbicide applications.

GROUNDWATER CONTAMINATION

Groundwater contamination with pesticides is a growing public concern. Pesticides can contaminate groundwater by movement from small areas contaminated through factors such as spills, rinsing spray cans, rinsing tanks, and back-siphoning, (point source) or by movement of pesticides used according to their label on relatively large land areas (non-point source). Point source contamination probably accounts for most groundwater contamination problems and can be minimized by using the following precautions:

1. Mix pesticides away from wells and other water sources maintaining at least a 100-ft buffer between water source and sprayer.
2. Prevent back-siphoning into the well by using an anti-backflow check valve, or maintaining an air gap between the end of the fill hose and the surface water level in the sprayer.

3. Triple rinse pesticide containers and add the rinsate to the spray tank.
4. Minimize extra spray solution by mixing only the quantity of spray required. Apply extra spray solution to fallow land or to a labelled crop following label recommendations.
5. Properly seal active and abandoned wells.

Non-point source groundwater contamination occurs over a broad area as a result of labelled pesticide uses. Groundwater contamination can occur as the chemical is leached by water through the soil profile. The potential for non-point source pollution of groundwater with a herbicide depends on soil type, irrigation or precipitation, depth of groundwater, herbicide application rate and frequency, and herbicide mobility. Non-point pollution of groundwater can be minimized by using the following practices:

1. Select herbicides with short residual and limited mobility in soil.
2. Properly calibrate sprayers to prevent application of excessive rates of herbicide.
3. Apply herbicides only when necessary and follow all herbicide label recommendations and guidelines.
4. Use good agronomic practices that minimize weed competition and maximize herbicide performance such as crop rotation, herbicide rotation, timely cultivation, and cover crops.
5. Use band applications rather than broadcast applications to reduce the amount of pesticide used per acre.
6. Do not apply herbicides near open water.
7. Avoid use of persistent and/or mobile herbicides on soil with a shallow water table.

For further information on ways to prevent groundwater contamination with pesticides, refer to NDSU Extension publications EB No. 49, Persistence and Mobility of Pesticides in Soil and Water, and E-979, Managing Pesticides to Prevent Groundwater Contamination.

PREEMERGENCE HERBICIDES:

Good weed control with preemergence herbicides depends on many factors, including rainfall after application, soil moisture, soil temperature, soil type and weed species. For these reasons, preemergence herbicides applied to the soil surface sometimes fail to give satisfactory weed control. Herbicides which are incorporated into the soil surface usually require less rainfall after application for effective weed control than unincorporated herbicides. Weeds emerging through a preemergence herbicide treatment may be controlled by rotary hoeing or harrowing without reducing the effect of the herbicide.

INCORPORATION OF HERBICIDES:

Many herbicides applied before crop and weed emergence need to be incorporated to give optimum weed control. Included in this group are butylate (Sutan +, Genate +), cycloate (Ro-Neet), EPTC (Eptam, Genep, Eradicane, Eradicane Extra), ethalfluralin (Sonalan), triallate (Far-go, Showdown), and trifluralin (Treflan). Incorporation of alachlor (Lasso), ethofumesate (Nortron), metolachlor (Dual), and pendimethalin (Prowl) generally improves weed control.

An estimate of the efficiency of an incorporating tool can be obtained by operating the tool through flour or lime which has been spread thickly over the soil. A thorough incorporation should cover most of the flour or lime and mix it uniformly through the soil. Several tillage tools have been used successfully for the incorporation of herbicides. Some herbicides require more thorough incorporation than others and the incorporation method should be appropriate for the herbicide.

PESTICIDE COMBINATIONS:

The recommended sequence of addition of formulations for tank mixes is a) water, b) wettable powders or dry flowables plus agitation, c) liquid flowables, d) emulsifiable concentrates, and e) solutions. Compatibility testing as described in the next section can be used to determine if tank mixes of pesticides will form a uniform mixture in the spray tank. The effect of postemergence herbicides often is increased when applied to areas already treated with a preemergence or preplant herbicide. Combinations of certain herbicides may give better weed control than use of the individual herbicide alone. However, loss of weed control or increased crop damage may result from the use of certain other herbicides in combination. Herbicide combinations should be used with caution until experience or research has shown that the combination is effective and safe. See the discussion on individual crops for more specific information.

Several herbicide-insecticide combinations have been shown to increase crop injury compared to either pesticide applied alone. For example, crop injury has increased when bentazon plus malathion, sulfonyleurea herbicides plus organophosphate insecticides, and propanil plus organophosphate or carbamate insecticides were applied. Increased crop injury even has occurred with sequential applications. Efficacy data on herbicide-insecticide mixtures are limited because of the number of potential combinations. Non-registered tank-mixtures should be used with caution until experience or research has shown that the combination is effective and safe.

Agricultural pesticides that are tank mixed often are registered for use as a mixture by the Environmental Protection Agency. Non-registered tank mixes may be applied if all pesticides in the mixture are registered by the Environmental Protection Agency on the crop being treated. However, the user must assume liability for crop injury, inadequate weed control and illegal residues if the combination is not a labelled tank mixture.

HERBICIDE-LIQUID FERTILIZER COMBINATIONS:

Thorough mixing and continuous, vigorous agitation are required to obtain an even application of herbicide-fertilizer combinations. Some herbicide-fertilizer combinations will not form a uniform mixture even with thorough agitation. Compatibility of the herbicide in the liquid fertilizer should be tested before the herbicide is added to the tank. The compatibility test may be conducted by combining small quantities of the components being mixed in the same proportions used in the spray tank. One teaspoon of liquid herbicide in 1.5 pints of fertilizer is equivalent to one quart of herbicide in 35 gallons of fertilizer. One teaspoon of dispersible granules in 1.5 pints of fertilizer is equivalent to 1 pound of granules in 16 gallons of fertilizer. One teaspoon of wettable powder in 1.5 pints of fertilizer is equivalent to 1 pound of wettable powder in 32 gallons of fertilizer. Wettable powders and dispersible granules should be mixed with a small amount of water to form a slurry before adding to the fertilizer. For other fertilizer volumes per acre or herbicide rates, adjust proportions accordingly. Close the jar and shake well. Watch the mixture for several seconds and check again 30 minutes later. If the mixture does not separate, the combination is compatible. If the mixture separates or gets very thick or syrupy, do not combine for field application. Mixing ability may be improved by adding a compatibility agent such as Compex or Unite. Different batches of fertilizer may differ in their mixing properties and should be tested separately.

HERBICIDE-DRY FERTILIZER COMBINATIONS:

Many preplant incorporated herbicides are registered for impregnation on dry bulk fertilizer. Ammonium sulfate, ammonium phosphate-sulfate, diammonium phosphate, potassium chloride, superphosphate, treble superphosphate, and urea are some of the approved fertilizer materials for impregnation. Impregnated fertilizer should be applied immediately and incorporated according to label instructions. Accurate spreader calibration and uniform fertilizer distribution are essential. Consult the herbicide label for minimum amounts of fertilizer per acre and for maximum amounts of herbicide per given weight of fertilizer. Ranges of 200 to 400 lbs/A of dry bulk fertilizer are recommended to maintain uniformity of herbicide application.

CHEMICAL WEED CONTROL FOR FIELD CROPS

Hard Red Spring and Durum Wheat

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Refer- ence**
Glyphosate (Roundup, Roundup RT, Ranger)	0.19 to 0.75 (0.5 to 2 pt 0.5 to 2 pt, 0.75 to 3 pt)	Emerged grass and broadleaf weeds.	Preplant or any- time prior to crop emergence.	A nonselective, translocated, postemergence herbicide. No soil residual activity. Apply Roundup and Roundup RT with a nonionic surfactant at 0.5% v/v. Additives are not needed with Ranger. Combinations of 2,4-D or dicamba with glyphosate have increased the spectrum of weeds controlled. Commercial mixtures of 2,4-D + glyphosate (Landmaster II, Landmaster BW) and dicamba + glyphosate (Fallow Master) are available.	142,143
Paraquat (Gramoxone Extra)	0.47 to 0.94 (1.5 to 3.0 pt)	Emerged annual grass and broadleaf weeds		A nonselective, postemergence herbicide. No soil residual activity. Apply with nonionic surfactant at 0.12 to 0.25% v/v. good coverage is essential. Restricted use herbicide.	141
Triallate (Far-Go, Showdown)	1 (1 qt Far-Go, 10 lb Far-Go 10G)	Wild oats	Three days or more prior to seeding or immediately after seeding.	Preplant incorporate with field cultivator set to cut 4 inches deep. Postplant incorporate with harrow set shallower than seed depth.	5,36
	1 liquid (1 qt Far-Go), 1.25 lb granule (12.5 lb Fargo-Go 10G, 6.25 lb Showdown)		Fall-after October 15 and until freeze-up.	Keep spring tillage depth to minimum. Triallate granules may be surface applied without incorporation in the fall.	5,12
Triallate + Trifluralin (Buckle)	1 to 1.25+ 0.3 to 0.4 (10 to 12.5 lb G)	Wild oats and foxtails (pigeongrass)	Fall-within 3 weeks of freeze up.	Do not apply to Hard Red Spring wheat. Incorporate once in the fall within 24 hours after application. Keep spring tillage depth shallower than fall. Wheat stand reduction may occur. Do not apply on soil treated with trifluralin at 0.5 lb/A or more the previous year.	5,36
	1 + 0.3 (10 lb G)		Three days or more prior to seeding.		
Durum wheat only					
Triallate (Far-Go) + Trifluralin (Treflan)	1 (1 qt) + 0.5 (1 pt 4E)	Wild oats and foxtails (pigeongrass)	Immediately after seeding	Plant wheat 2 to 2.5 inches deep. Incorporate herbicide shallowly twice with flex-tyne or diamond harrows to depth of 1 to 1.5 inches.	5,36
Trifluralin (Treflan)	0.5 to 0.75 (1 to 1.5 pt 4E)	Foxtails (pigeongrass)			4,46
	0.5 to 0.75 (1 to 1.5 pt 4E) (5 to 7.5 lb 10 G)		Fall-after September 1 and until freeze-up	Incorporate once in fall within 24 hours after application. keep spring tillage depth shallower than fall. Wheat stand reduction may occur.	1,2, 12,16, 47

* Formulation values are given for the most commonly used products and not included for most mixtures because of inadequate space. To calculate the amount of formulation needed for a specific rate of active ingredient, see page 1.

** Reference paragraph number indicates appropriate paragraph in the narrative.

Hard Red Spring and Durum Wheat

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Reference**
Bromoxynil (Buctril)	0.25 to 0.38 (1 to 1.5 pt)	Wild buckwheat, volunteer sunflower, and most broadleaf weeds.	Crop-emergence until just prior to boot.	Apply when weeds are in early seedling stage for best results. Weak on wild mustard. Restricted use herbicide.	29,49, 50,51,
Bromoxynil + MCPA ester (Bronate)	0.19 to 0.38 + 0.19 to 0.38 (0.75 to 1.5 pt)	Wild buckwheat, volunteer sunflower and most broadleaf weeds.	Crop-3rd leaf until just prior to boot.	Apply when weeds are in early seedling stage for best results. Volunteer sunflower control better than 0.5 lb/A 2,4-D. Restricted use herbicide.	29,49, 50,51
Picloram (Tordon 22K) + 2,4-D or MCPA	1/64 to 1/43 + 0.25 to 0.38 (1 to 1.5 fl oz. + 0.5 to 0.75 pt of 4 lb/gal conc.)	Wild buckwheat and most broadleaf weeds.	Crop-3rd through 5th leaf stage.	Do not apply to durum wheat. Use only on land to be planted the following year to grass, small grains, corn, sorghum or flax. Picloram is a restricted herbicide.	18,28, 49,50, 51
Hard Red Spring Wheat Only					
Dicamba (Banvel, Banvel SGF) + 2,4-D amine	0.06 + 0.25 (0.12 pt Banvel or 0.25 pt SGF + 0.5 pt of 4 lb/gal conc.)	Wild buckwheat and most broadleaf weeds.	Crop-4 leaf stage only.	Proper timing of application is important to avoid crop injury.	27
Dicamba (Banvel, Banvel SGF) + MCPA amine	0.06 to 0.12+ 0.25 to 0.38 (0.12 to 0.25 pt Banvel or 0.25 to 0.5 pt SGF + 0.5 to 0.75 pt of 4 lb/gal MCPA)	Wild buckwheat and most broadleaf weeds.	Crop-2nd through 4th leaf stage.	Use the low dicamba rate and the high MCPA rate on 4 leaf wheat.	27,49, 50,51
MCPA amine or MCPA ester	0.25 to 0.66 (0.5 to 1.33 pt of 4 lb/gal conc.)	Broadleaf weeds	Crops-emergence until just prior to boot.	Apply 0.25 to 0.5 lb/A from emergence to tiller stage. Use 0.5 lb/A for volunteer sunflower and kochia. Use the high rate for control of large weeds or perennial weeds.	25,34 49,50, 51
2,4-D amine or 2,4-D L.V. ester	0.25 to 0.5 (0.5 to 1 pt of 4 lb/gal conc.)	Broadleaf weeds	Crop-5th leaf until just prior to boot.	Do not apply from early boot to dough stage. Use 0.5 lb/A for volunteer sunflower and kochia.	25,34, 49,50 51
Clopyralid + 2,4-D (Curtall)	0.09 + 0.5 (2 pt)	Canada thistle and other broadleaf weeds	Crop-4 leaf stage through jointing	Do not rotate to any crop except small grains, grass, or sugarbeets within one year of application.	23,26, 135
Clopyralid + MCPA (Curtall M)	0.09 to 0.12 + 0.51 to 0.68 (1.75 to 2.33 pt)	Canada thistle and other broadleaf weeds	Crop-3 leaf through jointing		
Chlorsulfuron (Glean)	1/28 (1/6 oz)	Most broadleaf weeds.	Crop-2 leaf stage and just prior to boot. Vic durum-4 leaf stage until just prior to boot. Weeds-small, less than 2 inches tall or 2 inches in diameter.	Do not apply within 22 months of last chlorsulfuron treatment. See paragraph 24 about resistant weeds. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. Do not apply to soils above pH 7.8. See paragraph 21 for rotational restrictions.	21,24, 30

* Formulation values are given for the most commonly used products and not included for most mixtures because of inadequate space. To calculate the amount of formulation needed for a specific rate of active ingredient, see page 1.

** Reference paragraph number indicates appropriate paragraph in the narrative.

Hard Red Spring and Durum Wheat

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Refer- ence**
Metsulfuron (Ally) + a broadleaf herbicide	1/267 (0.1 oz) + appropriate rate	Most broadleaf weeds	HRS wheat - 2 leaf stage until just prior to boot Durum - 4 leaf stage until just prior to boot.	Should be applied as a tank- mixture with another broadleaf herbicide. Do not apply within 22 months of last metsulfuron or chloresulfuron treatment. See paragraph 24 about resistant weeds. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. Do not apply to soils above pH 7.9. See paragraph 22 for rotational restrictions.	22,24, 31
DPX-M6316 + DPX-L5300 (Harmony Extra)	1/111 to 1/53 + 1/200 to 1/111 (0.3 to 0.6 oz)	Broadleaf weeds.	Crop-2 leaf stage to jointing.	Should be applied as a tank- mixture with another broadleaf herbicide in areas of known weed resistance. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. See paragraph 24 about weed resistance.	32,33
DPX-L5300 (Express) + a broadleaf herbicide	1/128 to 1/64 (1/6 to 1/3 oz) + appropriate rate	Broadleaf weeds	Crop-2 leaf until just prior to flag leaf emergence		
Propanil + MCPA (Stampede CM)	0.94 + 0.25 (2.5 pt)	Green and yel- low foxtail (pigeongrass) and annual broadleaf weeds	Weeds-2 to 4 leaf, crop-2nd through 4th leaf	Application to foxtail larger than 3 leaves or wheat larger than 4 leaves may result in reduced weed control or increased wheat injury.	45
Barban (Carbyne 2EC)	0.25 to 0.37 (1 to 1.5 pt of 2 lb/gal conc.) 0.5 (2 pt of 2 lb/gal conc.)	Wild oats	Wild oats in 2-leaf stage Wild oats in 2.5 to 3.5 leaf stage.	Wild oats usually develop to the 2-leaf stage 9 days after emergence. Wild oats control improves with the addition of 1 gal/A of aqueous nitrogen fertilizer. May be tank mixed with diclofop or difenzoquat. Control decreases as wild oats stage increases.	37,38, 39
Diclofop (Hoelon)	0.75 to 1.0 (2 to 2.7 pt)	Wild oats and foxtails (pigeongrass)	Grass weeds-1 to 4 leaves.	Use the higher rate for dry conditions or grass weeds with 3 to 4 leaves. Oil improves consistency of weed control under dry conditions. Do not mix with any herbicide except bromoxynil or bromoxynil plus a low rate of MCPA ester (1.5 fl oz/A). Restricted use herbicide.	41,44
Diclofop (Hoelon) + Bromoxynil (Buctril)	0.75 to 1.0 + 0.25 to 0.37 (2 to 2.7 pt + 1.0 to 1.5 pt)	Wild oats, foxtails (pigeongrass), and broadleaf weeds	Grass weeds-2 to 3 leaves and small broadleaf weeds	Use the higher rate for dry conditions. Oil concentrate at 1 to 2 pt/A may increase weed control, but also increases injury potential. Diclofop and broxoxynil are restricted use herbicides.	29,34, 41,43, 44
Diclofop (Hoelon) + Bromoxynil (Buctril) + MCPA ester	1.0 + 0.25 to 0.38 + 0.05 (2.7 pt + 1.0 pt to 1.5 pt + 1.5 fl oz)		Grass weeds-1 to 3 leaves and small broadleaf weeds		

Formulation values are given for the most commonly used products and not included for most mixtures because of inadequate space. To calculate the amount of formulation needed for a specific rate of active ingredient, see page 1.

** Reference paragraph number indicates appropriate paragraph in the narrative.

Hard Red Spring and Durum Wheat

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Refer- ence**
Difenzoquat (Avenge)	0.62 to 1 (2.5 to 4 pt)	Wild Oats	Wild oats in 3 to 5 leaf stage.	Use high rate on high populations of 3-leaf wild oats. Can be applied with 2,4-D, MCPA amine, bromoxynil, chlorsulfuron, metsulfuron, MCPA plus bromoxynil or clopyralid plus 2,4-D. Injury may occur when crop is under environmental stress. See paragraph 40 for varieties registered.	25,40
AC 222,293 (Assert)	0.38 to 0.47 (1.2 to 1.5 pt)	Wild oats, wild mustard, and winter annual mustards.	Crop - 2 leaf to jointing. Wild oats-1 to 4 leaf stage.	See narrative for rotational restrictions. Do not tank-mix with propanil plus MCPA, dicamba, picloram, or the amine formulations of 2,4-D or MCPA.	42

WINTER WHEAT

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Refer- ence**
Glyphosate (Roundup, Roundup RT, Ranger)	0.19 to 0.75 (0.5 to 2 pt 0.5 to 2 pt, 0.75 to 3 pt)	Emerged grass and broadleaf weeds.	Preplant or any- time prior to crop emergence.	A nonselective, translocated, postemergence herbicide. No soil residual activity. Apply Roundup and Roundup RT with nonionic surfactant at 0.5% v/v. Additives are not needed with Ranger. Commercial mixtures of 2,4-D + glyphosate (Landmaster II, Landmaster BW), and dicamba + glyphosate (Fallow Master) are available.	142,143
Paraquat (Gramoxone Extra)	0.47 to 0.94 (1.5 to 3.0 pt)	Emerged annual grass and broadleaf weeds.	Preplant or any- time prior to crop emergence.	A nonselective, postemergence herbicide. No soil residual activity. Apply with nonionic surfactant at 0.12 to 0.25% v/v. Good coverage is essential. Restricted use herbicide.	141
Triallate (Far-Go)	1.25 (1.25 qt) (12.5 lb 10G)	Wild oats	Before or after seeding.	Preplant incorporate with field cultivator set to cut 4 inches deep. Postplant incorporate with harrow set shallower than seed depth.	12

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** Reference paragraph number indicates appropriate paragraph in the narrative.

WINTER WHEAT

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Refer- ence**
Bromoxynil (Buctril)	0.25 to 0.38 (1 to 1.5 pt)	Wild buckwheat, volunteer sun- flower and most broadleaf weeds.	Crop-emergence until just prior to boot.	Apply when weeds are in early seedling stage for best results. Weak on wild mustard. Restricted use herbicide.	29,49, 50,51
Bromoxynil + MCPA ester (Bronate)	0.19 to 0.38 + 0.19 to 0.38 (0.75 to 1.5 pt)		In spring prior to boot stage	Apply while weeds are small and before they are shaded by the crop. Do not apply in the fall. Restricted use herbicide.	
Picloram (Tordon 22K) + 2,4-D or MCPA	1/64 to 1/43 + 0.25 to 0.37 (1 to 1.5 fl. oz + 0.5 to 0.75 pt of 4 lb/gal conc.)	Wild buckwheat and most broad- leaf weeds	In spring after resumption of active crop growth and be- fore early boot stage	Do not apply in the fall. Use only on land to be planted the following year to grass, small grains, corn, sorghum or flax. Picloram is a restricted use herbicide.	18,20, 49,50, 51,
Barban (Carbyne 2EC)	0.25 to 0.37 (1 to 1.5 pt of 2 lb/gal conc.)	Wild oats	Wild oats in 2-leaf stage	Wild oats usually develop to the 2-leaf stage 9 days after emergence. Wild oats control improves with the addition of 1 gal/A of aqueous nitrogen fertilizer. Control decreases as wild oats stage increases.	37,38 39
	0.5 (2 pt of 2 lb/gal conc.)		Wild oats in 2.5 to 3.5 leaf stage.		
Diclofop (Hoelon)	0.75 to 1.0 (2 to 2.7 pt)	Wild oats and foxtail (pigeongrass)	Grass weeds- 1 to 4 leaves; before jointing of wheat.	Use the higher rates for dry conditions or grass weeds with 3 to 4 leaves. Do not mix with any herbicide except bromoxynil or bromoxynil plus a low rate of MCPA ester (1.5 fl oz/A). Restricted use herbicide.	41,44
Diclofop (Hoelon) + Bromoxynil (Buctril)	0.75 to 1.0 + 0.25 to 0.38 (2 to 2.7 pt + 1 to 1.5 pt)	Wild oats, foxtail (pigeongrass), and broadleaf weeds	Grass weeds- 2 to 3 leaves; small broadleaf weeds; before jointing of wheat.	Use the higher rate for dry conditions. Diclofop and bromoxynil are restricted use herbicides. Oil concentrate at 1 to 2 pt/A may increase weed control, but also increases crop injury potential.	29,34, 41,43, 44
Diclofop (Hoelon) + Bromoxynil (Buctril) + MCPA ester	1.0 + 0.25 to 0.38 + 0.05 (2.7 pt + 1 to 1.5 pt + 1.5 fl oz)				
Difenzoquat (Avenge)	0.62 to 1 (2.5 to 4 pt)	Wild oats	3 to 5-leaf stage of wild oats. Crop prior to flag leaf emergence.	Use high rate on high popula- tions of 3-leaf stage wild oats. Can be applied with chlorsulfuron, 2,4-D, MCPA, metsulfuron, bromoxynil, MCPA plus bromoxynil, or clopyralid plus 2,4-D. Injury may occur when crop is under environmental stress.	40
AC 222,293 (Assert)	0.38 to 0.47 (1.2 to 1.5 pt)	Wild mustard, wild oats, and winter annual mustards.	Crop-2 leaf to jointing. Wild oats-1 to 4 leaf stage.	See narrative for rotational restrictions. Do not tank mix with propanil plus MCPA, dicamba, picloram, or the amine formulations of 2,4-D or MCPA.	42

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WINTER WHEAT

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Refer- ence**
Chlorsulfuron (Glean)	1/128 (1/6 oz)	Most broadleaf weeds.	In spring, crop in 2 leaf stage and until just prior to boot; weeds-small, less than 2 inches tall or 2 inches in diameter.	Do not apply within 22 months of the last chlorsulfuron treatment. See paragraph 24 about resistant weeds. Apply postemergence treatments with a nonionic surfactant at 0.12 to 25% v/v. Do not apply to soils above pH 7.9. See paragraph 21 for rotational restrictions.	21,24, 30,49, 50,51, 52
Metsulfuron (Ally) + a broadleaf herbicide	1/267 (0.1 oz) + appropriate rate.	Wild mustard and certain annual broad- leaf weeds.	Postemergence, crop in 2 leaf stage until just prior to boot.	Should be applied as a tank- mixture with another broadleaf herbicide. Do not apply within 22 months of last metsulfuron treatment. See paragraph 24 about resistant weeds. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. Do not apply to soils above pH 7.9. See paragraph 22 for rotational restrictions.	22,24, 31,49, 50,51, 52
DPX-M6316 + DPX-L5300 (Harmony Extra)	1/111 to 1/53 + 1/200 to 1/111 (0.3 to 0.6 oz)	Broadleaf weeds	Crop-2 leaf stage to jointing.	Should be applied as a tank- mixture with another broadleaf herbicide in areas of known weed resistance. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. See paragraph 24 about weed resistance.	32,33
DPX-L5300 (Express) + a broadleaf herbicide	1/128 to 1/64 (1/6 to 1/3 oz) + appropriate rate		Crop-2 leaf until just prior to flag leaf emergence.		
Clopyralid + 2,4-D (Curtall)	0.09 + 0.5 (2 pt)	Canada thistle and other broadleaf weeds	Crop-4 leaf stage until jointing.	Do not rotate to any crop except small grains, grass, or sugarbeets within 1 year of application.	23,26 135
Clopyralid + MCPA (Curtall M)	0.09 to 0.12 + 0.51 to 0.68 (1.75 to 2.33 pt)	Canada thistle and other broadleaf weeds	Crop-3 leaf through jointing		
2,4-D amine or 2,4-D L.V. ester	0.25 to 0.5 (0.5 to 1 pt of 4 lb/gal conc.)	Broadleaf weeds.	In spring when wheat is well tillered but prior to boot stage.	Do not apply from early boot to dough stage. Do not apply in the fall.	25,34, 49,50 51
MCPA amine or MCPA ester	0.25 to 0.5 (0.5 to 1 pt of 4 lb/gal conc.)		In spring from 4-leaf stage and prior to boot stage.		
Dicamba (Banvel, Banvel SGF) + MCPA amine	0.06 to 0.12 + 0.25 to 0.38 (0.12 to 0.25 pt Banvel or 0.25 to 0.5 pt SGF + 0.5 to 0.75 pt of 4 lb/gal MCPA)	Wild buck wheat and most broad- leaf weeds.	In spring after winter dormancy but before wheat begins to joint.	Do not apply in the fall.	27,49, 50,51
Dicamba (Banvel, Banvel SGF) + 2,4-D amine	0.06 + 0.25 (0.12 pt Banvel or 0.25 pt SGF + 0.5 pt of 4 lb/gal 2,4-D amine)		Crop-4 leaf to jointing.		

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BARLEY

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Refer- ence**
Glyphosate (Roundup, Roundup RT, Ranger)	0.19 to 0.75 (0.5 to 2 pt, 0.5 to 2 pt, 0.75 to 3 pt)	Emerged grass and broadleaf	Preplant or any- time prior to crop emergence. weeds.	A nonselective, translocated postemergence herbicide. No soil residual activity. Apply Roundup and Roundup RT with nonionic surfactant at 0.5% v/v. Additives are not needed with Ranger. Combinations of 2,4-D or dicamba with glyphosate have increased the spectrum of weeds controlled. Commercial mixtures of 2,4-D + glyphosate (Landmaster II, Landmaster BW) and dicamba + glyphosate (Fallow Master) are available.	142, 143
Paraquat (Gramoxone Extra)	0.47 to 0.94 (1.5 to 3 pt)	Emerged annual grass and broadleaf weeds.		A nonselective, postemergence herbicide. No soil residual activity. Apply with nonionic surfactant at 0.12 to 0.25% v/v. Good coverage is essential. Restricted use herbicide.	141
Triallate (Far-Go, Showdown)	1.25 (1.25 qt. Far-Go, 12.5 lb Far-Go 10G)	Wild oats	Before or after planting	Apply on smooth soil surface and incorporate immediately in top 2 inches by cultivation.	1,5, 36
	1.25 liquid (1.25 qt Far-Go), 1.25 to 1.5 granule (12.5 to 15 lb Far-Go 10G, 6.25 to 7.5 lb Showdown)		Fall-after October 15.	Keep spring tillage to a minimum. The lower rate has generally given adequate control. Triallate granules may be surface applied in the fall without incorporation.	1,5, 11
Triallate (Far-Go) + Trifluralin (Treflan)	1 (1 qt) + 0.5 (1 pt 4E)	Wild oats and foxtails (pigeongrass)	In spring-immedi- ately after plant- ing	Plant barley 2 to 3 inches deep. Incorporate shallowly twice with flex-tyne or diamond harrow to depth of 1 to 1.5 inches	5,36
Triallate + Trifluralin (Buckle)	1 to 1.25 + 0.3 to 0.4 (10 to 12.5 lb G)	Wild oats and foxtails	Fall-within 3 weeks of freeze-up. Spring-prior to planting.	Incorporate once in fall within 24 hours after application. Keep spring tillage depth shallower than fall. Barley stand reduction may occur.	5,36
Trifluralin (Treflan)	0.5 (1 pt 4E, 5 lb 10G)	Foxtails (pigeongrass)	Spring-preplant incorporated	Incorporate twice to a depth of 2 to 3 inches. Seed barley 2 inches deep.	1,2,4, 12,16, 46
	0.5 to 0.75 (1 to 1.5 pt 4E)		Spring-after planting	Plant barley 2 to 3 inches deep. Incorporate shallowly twice with flex-tyne or diamond harrow to depth of 1 to 1.5 inches.	
	0.5 to 0.75 (1 to 1.5 pt 4E, 5 to 7.5 lb 10G)		Fall-after September 1	Incorporate once in fall within 24 hours after application. Keep spring tillage depth shallower than fall. Stand reduction may occur.	2,12, 16,47

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BARLEY

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Refer- ence**
Bromoxynil (Buctril)	0.25 to 0.38 (1 to 1.5 pt)	Wild buckwheat, volunteer sun- flower, and most broadleaf weeds.	Crop-emergence and prior to boot	Apply when weeds are in early seedling stage for best results. Weak on wild mustard. Restricted use herbicide.	29,49, 50,51,
Chlorsulfuron (Glean)	1/128 (1/6 oz)	Most broad- leaf weeds.	Crop in 2 leaf stage and prior to boot, weeds-small, less than 2 inches tall or 2 inches in diameter.	Do not apply within 22 months of the last chlorsulfuron treatment. See paragraph 24 about resistant weeds. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. Do not apply to soils above pH 7.9. See paragraph 21 for rotational restrictions.	21,24, 30
Metsulfuron (Ally) + a broadleaf herbicide	1/267 (0.1 oz) + appropriate rate	Most broad- leaf weeds	Crop in 2 leaf stage until just prior to boot	Should be applied as a tank- mixture with another broadleaf herbicide. Do not apply within 22 months of last metsulfuron or chlorsulfuron treatment. See paragraph 24 about resistant weeds. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. Do not apply to soils above pH 7.9. See paragraph 22 for rotational restrictions.	22,24, 31,49, 50,51, 52
DPX-M6316 + DPX-L5300 (Harmony Extra)	1/111 to 1/53 + 1/200 to 1/111 (0.3 to 0.6 oz)	Broadleaf weeds	Crop-2 leaf stage to jointing.	Should be applied as a tank- mixture with another broadleaf herbicide in areas of known resistance. Apply with a non- ionic surfactant at 0.12 to 0.25% v/v. See paragraph 24 about weed resistance.	32,33
DPX-L5300 (Express) + a broadleaf herbicide	1/128 to 1/64 (1/5 to 1/3 oz) + appropriate rate.	Broadleaf weeds	Crop-2 leaf until just prior to flag leaf emergence.		
Propanil + MCPA (Stampede CM)	0.94 + 0.25 (2.5 pt)	Foxtails (pigeongrass), and some annual broadleaf weeds.	Weeds 2 to 4- leaf stage, crop 2 to 4-leaf stage.	Application to foxtail larger than 3 leaves or barley larger than 4 leaves may result in reduced weed control or increased crop injury.	45
Bromoxynil + MCPA ester (Bronate)	0.19 to 0.25 + 0.19 to 0.25 (0.75 to 1 pt)	Wild buckwheat, volunteer sun- flower and most broadleaf weeds.	Crop-3rd leaf until just prior to boot.	Apply when weeds are in early seedling stage for best results. Volunteer sunflower control better than 0.5 lb/A of 2,4-D. Restricted use herbicide.	29,49, 50,51
Picloram (Tordon 22K) + 2,4-D or MCPA	1/64 to 1/43 + 0.25 to 0.37 (1 to 1.5 fl. oz + 0.5 to 0.75 pt of 4 lb/gal conc.)	Wild buck- wheat and most broad- leaf weeds	Crop-3rd through 5th-leaf stage	Use only on land to be planted the following year to grass, small grains, corn, sorghum, or flax. Picloram is a restricted use herbicide.	18,28, 49,50, 51

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BARLEY

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Refer- ence**
Clopyralid + 2,4-D (Curtall)	0.09 + 0.5 (2 pt)	Canada thistle and other broadleaf weeds	Crop-4 leaf stage through jointing	Do not rotate to any crops except small grains, grasses, or sugarbeets within 1 year of application.	23,26, 135
Clopyralid + MCPA (Curtall M)	0.09 to 0.12 + 0.51 to 0.68 (1.75 to 2.33 pt)	Canada thistle and other broadleaf weeds	Crop-3 leaf through jointing		
2,4-D amine or 2,4-D L.V. ester	0.25 to 0.5 (0.5 to 1 pt of 4 lb/gal conc.)	Broadleaf weeds	Crop-5th leaf until prior to boot.	Do not apply from early boot to dough stage. Barley more susceptible than wheat. Use 0.5 lb/A for volunteer sunflower and kochia.	25,34, 49,50,
MCPA amine or MCPA ester	0.25 to 0.66 (0.5 to 1.33 pt of 4 lb/gal conc.)	Broadleaf weeds	Crop-emergence until prior to boot.	Apply 0.25 to 0.5 lb/A from emergence to tiller stage. Use 0.5 lb/A for volunteer sunflower and kochia. Use the high rate for control of large weeds or perennial weeds.	25,34, 49,50,
Barban (Carbyne 2EC)	0.25 to 0.37 (1 to 1.5 pt of 2 lb/gal conc.)	Wild oats	Wild oats in 2- leaf stage	Wild oats usually develop to the 2-leaf stage 9 days after emergence. Wild oats control improves with the addition of 1 gal/A of aqueous nitrogen fertilizer. Control decreases as wild oats stage increases.	37,38, 39
	0.5 (2 pt of 2 lb/gal conc.)		Wild oats in 2.5 to 3.5 leaf stage.		
Diclofop (Hoelon)	0.75 to 1 (2 to 2.66 pt)	Wild oats and foxtail (pigeongrass)	Grass weeds-1 to 3 leaves. Crop-up to 4 leaf stage.	Use the higher rate for dry conditions or grass weeds with 3-4 leaves. Do not mix with oil or any herbicide except bromoxynil or bromoxynil plus a low rate of MCPA ester (1.5 fl oz/A). Restricted use herbicide.	41,44
Diclofop (Hoelon) + Bromoxynil (Buctril)	0.75 to 1.0 + 0.25 to 0.38 (2 to 2.7 pt + 1.0 to 1.5 pt)	Wild oats, fox- tail (pigeon- grass) and annual broad- leaf weeds	Grass weeds in 2 to 3 leaf stage and small broadleaf weeds	Use the higher rate for dry conditions. Do not use oil additive with this mixture. Diclofop and Bromoxynil are restricted use herbicides.	29,34, 41,43, 44
Diclofop (Hoelon) + Bromoxynil (Buctril) + MCPA ester	1.0 + 0.25 to 0.38 + 0.05 (2.7 pt + 1 to 1.5 pt + 1.5 fl oz)				
Difenzoquat (Avenge)	0.62 to 1 (2.5 to 4 pt)	Wild oats	3 to 5-leaf stage of wild oats. Crop-prior to flag leaf emergence.	Cleared on all barley varieties. Use high rate on high populations of 3-leaf wild oats. Can be applied with chlorsulfuron, metsulfuron, 2,4-D, MCPA, bromoxynil, MCPA plus bromoxynil, or clopyralid plus 2,4-D.	40
AC 222,293 (Assert)	0.38 to 0.47 (1.2 to 1.5 pt)	Wild mustard, wild oats, and winter mustards.	Crop-2 leaf to jointing. Wild oats-1 to 4 leaf stage.	See narrative for rotational restrictions. Do not tank mix with propanil plus MCPA, dicamba, picloram, or the amine formulations of 2,4-D or MCPA.	42

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OATS

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Reference**
Glyphosate (Roundup, Roundup RT, Ranger)	0.19 to 0.75 (0.5 to 2 pt, 0.5 to 2 pt, 0.75 to 3 pt)	Emerged grasses and broadleaf weeds.	Preplant or any-time prior to crop emergence.	A nonselective, translocated, postemergence herbicide. No soil residual activity. Apply Roundup and Roundup RT with a nonionic surfactant at 0.5% v/v. Additives are not needed with Ranger. Combinations of 2,4-D or dicamba with glyphosate have increased the spectrum of weeds controlled. Commercial mixtures of 2,4-D + glyphosate (Landmaster II, Landmaster BW) or dicamba + glyphosate (Fallow Master) are available.	142, 143
MCPA amine or MCPA ester	0.25 to 0.5 (0.5 to 1 pt of 4 lb/gal conc.)	Broadleaf weeds	Oats-emergence to boot	Early jointing stage most susceptible. Possible injury to oats at any growth stage. Use 0.5 lb/A for volunteer sunflower.	25,34 49,50
Bromoxynil (Buctril)	0.25 to 0.38 (1 to 1.5 pt)	Wild buck-wheat, volunteer sunflower, and most broadleaf weeds	Crop-emergence until just prior to boot.	Apply when weeds are in early seedling stage for best results. Weak on wild mustard. Restricted use herbicide.	29,49, 50,51
Bromoxynil + MCPA ester (Bronate)	0.19 to 0.38 0.19 to 0.38 (0.75 to 1.5 pt)		Oats-3 leaf to boot stage.	Apply when weeds are in early seedling stage for best results. Volunteer sunflower control better than 0.5 lb/A of 2,4-D. Restricted use herbicide.	29,49, 50,51
Chlorsulfuron (Glean)	1/128 (1/6 oz)	Most broadleaf weeds.	Crop in 2 leaf stage and prior to boot. Weeds-small, less than 2 inches tall or 2 inches in diameter.	Do not apply within 22 months of the last chlorsulfuron treatment. See paragraph 24 about resistant weeds. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. Do not apply to soils above pH 7.9. See paragraph 21 for rotational restrictions.	21,24 30,49, 50,51 52
Picloram (Tordon 22K) + MCPA amine	1/64 to 1/43 + 0.25 to 0.37 (1 to 1.5 fl. oz + 0.5 to 0.75 pt of 4 lb/gal conc.)	Wild buck-wheat and most broad-leaf weeds	Oats-3 through 5-leaf stage	Use only on land to be planted the following year to grass, small grains, corn, sorghum or flax. Picloram is a restricted use herbicide.	18,28, 49,50, 51
Dicamba (Banvel, Banvel SGF) + MCPA amine	0.06 to 0.12 + 0.25 to 0.38 (0.12 to 0.25 pt Banvel or 0.25 to 0.5 pt SGF + 0.5 to 0.75 pt of 4 lb/gal MCPA)		Oats-2 through 4 leaf stage	Use the low dicamba rate and the high MCPA rate on 4 leaf oats.	27,49, 50,51
Clopyralid + MCPA (Curtall M)	0.09 to 0.12 + 0.51 to 0.68 (1.75 to 2.33 pt)	Canada thistle and other broadleaf weeds.	Crop-3 leaf through jointing	Do not rotate to any crop except small grains, grass, or sugarbeet within 12 months of application.	23,26, 135

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RYE

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Reference**
2,4-D amine or 2,4-D L.V. ester	0.25 to 0.5 (0.5 to 1 pt of 4 lb/gal conc.)	Broadleaf weeds	In spring when rye is well tillered but prior to boot stage.	Do not apply from early boot to dough stage. Do not apply in the fall.	25,34, 49,50, 51
MCPA amine or MCPA ester	0.25 to 0.5 (0.5 to 1 pt of 4 lb/gal conc.)		In spring from 4-leaf stage and prior to early boot.		
Bromoxynil (Buctril)	0.25 to 0.38 (1 to 1.5 pt)	Wild buck-wheat and other broad-weeds.	In spring prior to to early boot stage	Apply while weeds are small and before they are shaded by the crop. Do not apply in the fall. Weak on wild mustard. Restricted use herbicide.	29,49, 50,51
Bromoxynil + MCPA ester (Bronate)	0.19 + 0.38 + 0.19 + 0.38 (0.75 to 1.5 pt)	Wild buck-wheat and other broad leaf weeds.	In spring prior to early boot stage	Apply while weeds are small and before they are shaded by the crop. Do not apply in the fall. Restricted use herbicide.	29,49, 50,51

SMALL GRAIN PRE-HARVEST

Herbicide	Act. Ingrid. lb/A (Formulation/A)*	Weeds	When to Apply	Remarks	Reference**
2,4-D L.V. ester	0.75 to 1.5 (1.5 to 3 pt of 4 lb/gal conc.)	Broadleaf weeds.	Crop-dough stage to harvest.	Use only when weeds may interfere with harvest operations. Do not feed straw to livestock. CAUTION: Drift to broadleaf crops is hazardous at this time.	135
Dicamba (Banvel) + 2,4-D	0.25 + 0.5 to 1 (0.5 pt + 1 to 2 pt of 4 lb/gal conc.)	Broadleaf weeds	Wheat-hard dough stage and green color is gone from the nodes of the stem.	A waiting interval of 10 to 14 days is required before harvest. Do not feed treated straw to livestock. CAUTION: Drift to broadleaf crops is hazardous at this time. Special North Dakota State label.	

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